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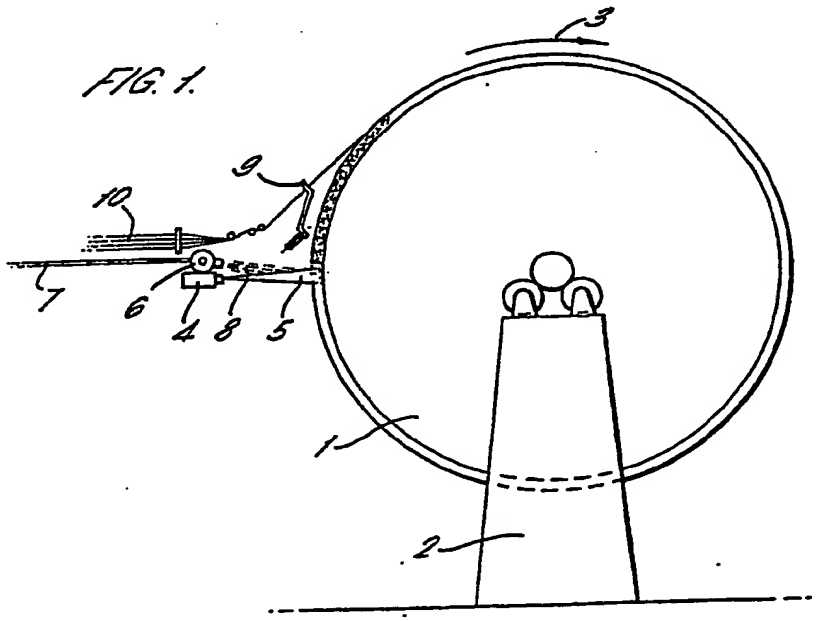
(54) Method of manufacturing a storage tank

(57) In the field of storage tanks formed of reinforced synthetic plastics, known manufacturing methods suffer the disadvantages that they are time consuming, and that strengthening ribs of the tanks are not securely affixed thereto.

The disclosure relates to a method of manufacturing a storage tank in which a first layer of durable plastics material (5) and fibre (7) is applied to a mandrel (1); a plurality of spaced rib-forming formers (12) is mounted about the layer of durable plastics material and fibre; and a further layer of plastics material and fibre (13) is applied over the first layer and the formers.

A tank thus formed has strong, integral reinforcing ribs, and the method is less complex than previous methods.



This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1982.

This print incorporates corrections made under Section 117(1) of the Patents Act 1977.

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FIG. 1.

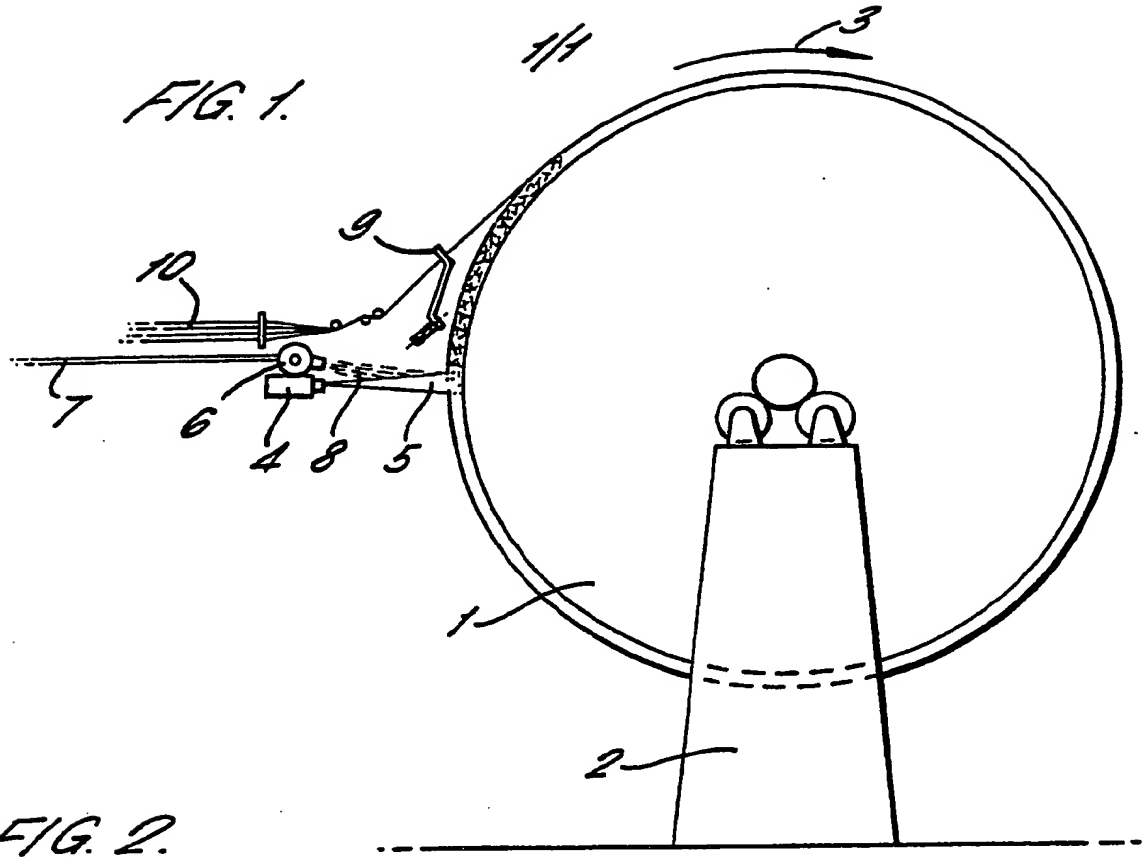


FIG. 2.

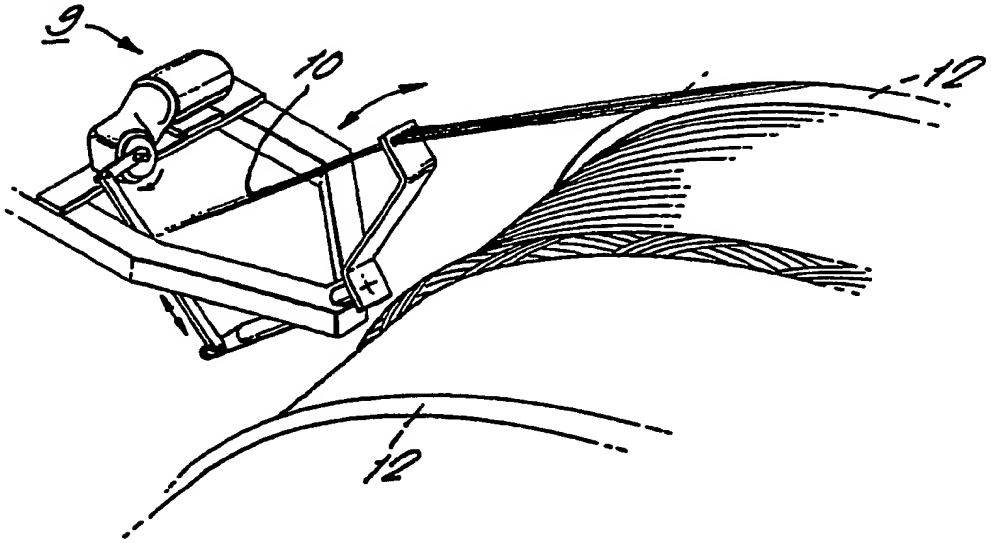
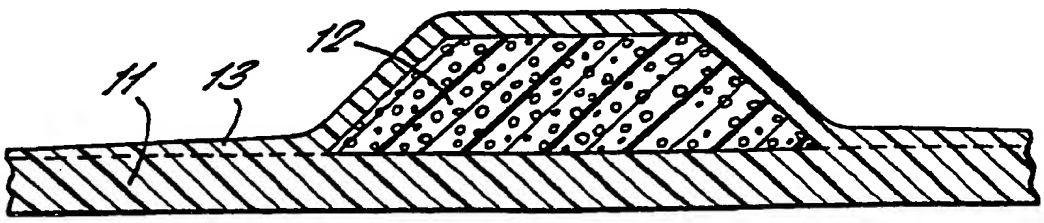


FIG. 3.



METHOD OF MANUFACTURING A STORAGE TANK

This invention relates to a method of manufacturing a storage tank, and in particular a storage tank for the underground storage of, for example, petroleum.

Underground storage tanks must be of sufficient strength to withstand the forces to which they are subjected in use and in installation, and must also resist corrosion by the material stored therein and by the external ground conditions.

In US-A-3661294 there is disclosed a storage tank formed of synthetic plastics material reinforced with chopped strands and rovings of glass fibre. The tank has the form of a right circular cylinder with closed ends, there being a plurality of spaced circumferential ribs formed on the tank to increase the strength thereof.

This known tank is manufactured by a method comprising the steps of applying a curable synthetic plastics material layer onto a release agent coating on a rotating cylindrical mandrel with tank end caps mounted thereon; applying a surface mat of glass fibres to the layer of plastics material; applying an intermediate layer of plastics material and chopped glass fibre strands, by spraying, onto the surface mat; possibly applying a second surface mat of glass fibre to the intermediate layer; and applying an outer plastics

material layer. The tank wall thus formed is then allowed to cure to at least a sufficiently firm condition to support the reinforcing ribs to be formed thereon. Reinforcing ribs in the form of hollow cardboard formers are then mounted about the tank wall at spaced locations and secured in place by strips of woven glass fibre roving tacked over the formers, there being wooden blocks at intervals around each former to support it on the tank wall. A wound layer of resin coated glass fibre roving is then applied to cover each of th reinforcing ribs, the layer extending over the tank wall a short distance on each side of each rib, the resin being cured by the application of heat. The complete structure comprising the tank wall with the ribs thereon is then finally completely cured by the application of heat.

This method of manufacture has the disadvantages that it is complex and thus time consuming and expensive, and that the reinforcing ribs are in effect separate structures bond d to the previously formed tank wall, there thus being the possibility of separation of the ribs from the tank wall.

According to this invention there is provided a method of manufacturing a storage tank, comprising the steps of applying a first layer of curable plastics material and fibre to a mandrel; mounting a plurality of rib-forming formers about the first layer on the mandrel in spaced parall l planes; applying a s cond layer of plastics material and fibr ov r the first layer and the formers; and removing the tank

with integral reinforcing ribs so formed from the mandrel.

The method of this invention has the advantage that it isrelatively simple to carry out and that the reinforcing ribs formed are integral parts of the tank wall rather than being subsequently attached parts of the complete tank.

The method of this invention will now be described by way of example with reference to the drawing, in which:-

Figure 1 is a schematic diagram of apparatus for use in carrying out the method;

Figure 2 is a perspective view of a rovings applying traversing guide used in the apparatus of Figure 1, together with part of a tank being manufactured; and

Figure 3 is a sectional view through a reinforcing rib of a tank manufactured by the method.

The apparatus shown in Figure 1 is basically a known apparatus and will therefore be described herein only as far as essential to an understanding of the method of the invention.

The apparatus comprises a cylindrical mandrel 1 mounted on pedestals 2 (only one shown) for rotation in the direction of the arrow 3.

Adjacent the surface of the mandrel 1, mounted on a common carriage (not shown) are a spray gun 4 for spraying curable synthetic plastics material 5 towards the surface of the mandrel 1; a chopper/sprayer 6 to which glass fibre rovings 7 are supplied and which serves to chop the rovings

into chopped strands 8 and spray these towards the surface of the mandrel 1; and a traversing guide 9 which serves for application of a plurality of glass fibre rovings 10 about the mandrel 1.

To manufacture a tank the mandrel 1 is coated with a release agent and the carriage carrying the spray gun 4, chopper/sprayer 6 and guide 9 is moved along the mandrel 1 parallel to the axis thereof, while the mandrel is rotated, the spray gun 4, chopper/sprayer 6 and guide 10 being operated to produce a first layer 11 of plastics material and fibre (chopped strands and rovings) on the mandrel 1. As shown in Figure 3 the first layer 11 provides substantially 80% of the final tank wall thickness. A plurality of trapezoidal section rib-forming formers 12 of foamed polyurethane material are then mounted in spaced parallel planes on the first layer 11 along the mandrel 1, as shown in Figure 2, and secured in position with tape. The operations carried out to form the first layer 11 are then repeated to form a second layer 13 of plastics material and fibre (chopped strands and rovings) over the first layer 11 and the formers 12. As shown in Figure 3 the second layer 13 provides the remaining substantially 20% of the final tank wall thickness.

As shown in Figure 2 the guide 9 is a traversing guide which during application of the first layer 11 is moved continuously, together with the spray gun 4 and chopper/sprayer 6, along the mandrel 1 without traversing

thereby to give the first layer 11 a uniform thickness throughout, and which during application of the second layer 13 moves between the formers 12 without traversing and stops, together with the spray gun 4 and chopper/sprayer 6, at each former 12 and there traverses for a number of rotations of the mandrel 1, whereby the second layer 13is formed with a substantially uniform thickness over all of the surfaces of all of the formers 12.

The tank thus formed is then allowed to cure, at least in part, on the mandrel 1 before being removed therefrom, to complete curing if necessary.

If required the method of the invention can be used to manufacture tanks in two parts with end caps as described in the above noted US-A-3661294.

CLAIMS

1. A method of manufacturing a storage tank, comprising the steps of applying a first layer of curable plastics material and fibre to a mandrel; mounting a plurality of rib-forming formers about the first layer on the mandrel in spaced parallel planes; applying a second layer of plastics material and fibre over the first layer and the formers; and removing the tank with integral reinforcing ribs so formed from the mandrel.

2. A method as claimed in Claim 1, in which the mandrel is rotated during application of the first and second layers.

3. A method as claimed in Claim 1 or Claim 2, in which the plastics material of the first and second layers is applied by spraying.

4. A method as claimed in any preceding claim, in which the rib-forming formers are of polyurethane foam material.

5. A method as claimed in any preceding claim, in which th fibr in the first and second layers comprises chopped strands and wound rovings.

6. A method as claimed in Claim 5, in which the chopped strands are applied by spraying.

7. A method as claimed in Claim 5 or Claim 6, in which the wound rovings are applied by a traversing guide which moves continuously along the mandrel without traversing during application of the first layer, and which moves between rib-forming formers without traversing and stops and traverses at each rib-forming former during application of the second layer, whereby the second layer is of greater thickness in the region of each rib-forming former than in the region intermediate adjacent rib-forming formers.

8. A method as claimed in any preceding claim, in which the first layer comprises substantially 80% of the final wall thickness.

9. A method of manufacturing a storage tank, substantially as hereinbefore described with reference to the drawing.

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